Home Economics and Women's gateway to science

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Abstract

Women are underrepresented in STEM overall, but they have fair representations in many fields such as chemistry, biology, psychology, and public health. We propose that women came to dominate these fields because they were exposed to these subjects in large numbers through collegiate home economics in the early twentieth century. Home economics was developed in the context of the prevailing germ theory and was designed as a feminine parallel to agriculture studies at land-grant universities. The unique historical circumstances and institutional setup tied home economic curricula closely to chemistry and biological sciences. Using college-level data from the Commissioners of Education reports, we establish a causal relationship between home economics and women's enrollment in science majors in the cross-section. We further compiled a panel of student majors from 1910-1940 with data collected from various college yearbooks. In a DID framework, we test the effect of opening a home economics major. Compared to when home economics was not available, the presence of home economics led to a higher proportion of women choosing a major in science and a substantial reduction in the science gender gap. To shed light on occupational outcomes, we compared the labor force participation rate

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across college counties using the 1910 census. While a larger Home Ec program negatively correlates with the female labor force participation rate, it positively correlates with the female labor force participation rate in technical occupations.

1 Introduction

What explains differences in group representation across academic fields or industries? Researchers are particularly interested in understanding the gender gap in science, technology, engineering, and math (STEM) fields. Over the past century, women have come to hold a growing share of STEM majors and jobs, although they are still underrepresented as a share of total STEM and there is substantial heterogeneity across STEM fields in terms of the speed of convergence and the size of the current gender gap (Goldin, 2014, 2021; Goldin et al., 2006; Kahn and Ginther, 2017). In particular, the share of women in life sciences and chemistry is much higher than in other physical sciences and engineering, a pattern that has been well documented over many samples and periods (Lubinski and Benbow, 1992; Xie and Shauman, 2003). This difference is perhaps surprising, since biology/chemistry on one hand and physical sciences/engineering on the other are similar on many dimensions, including requiring similar training and credentials and having similar demands on individuals' time, factors which explain a large share of the gender gap across fields (Goldin, 2014, 2021). Several scholars have pointed to differences in math demands between biology/chemistry and physical sciences/engineering; see Kahn and Ginther (2017) for a thorough survey. While the degree of math may differ between biology and physics, this would not seem to explain gender differences between all STEM fields, for instance between geology (40% female) and epidemiology (55% female).[1] Others have argued that differences in preferences (Wiswall and Zafar, 2015), norms (Zhao, 2020), psychology (Ceci et al., 2014), or expectations (Wiswall and Zafar, 2021) explain gender gaps, without addressing where these different preferences or expectations come from. What is needed is an explanation that can produce different gender ratios in seemingly very similar scientific disciplines and rationalize long-lasting differences in gender preferences across these fields.

In this paper, we provide a historical explanation for this puzzle: college home economics programs during the early 20th century introduced a generation of women to some scientific fields, but not others. As the only professional college major tailored to women, home economics was uniquely positioned to shape womens' views during a time when they were first attending college in large numbers (Goldin et al., 2006). Today home economics is typically associated with domesticity—and indeed one purpose of college home economics was to prepare women to become homemakers. But the early home economics curriculum was surprisingly science-heavy. Using data from historical college course catalogs, we document that from 1900 through 1930, about a third of the required credits in first and second year home economics programs were in biology and chemistry courses; in many cases freshmen home economics students took the same

[1] Data on gender ratios in these fields is from (National Center for Education Statistics, 2017).

courses as students majoring in agriculture, an applied science major. Physics and engineering courses, on the other hand, were exceedingly rare for home economics majors. Evidence from academic articles published in the Journal of Home Economics from 1909-1960 confirm that prior to the 1930s the field embraced rigorous scientific inquiry, especially related to biology and chemistry.

Why would the home economics curriculum in the first two decades of the 20th century affect gender ratios in science today? Boyd and Richerson (1985), Alesina et al. (2013), and Xue (2020), show that gendered attitudes may be transmitted across generations, and Eccles and Jacobs (1986) argue that this can be true in particular for academic stereotypes. If home economics led to a perception that biology and chemistry were "women sciences" at a time when beliefs about women's place in higher education were new and unsettled, it is plausible that these perceptions would perpetuate to the present. We modify a model by Altonji (1993); Altonji et al. (2012) to illuminate several channels through which the inclusion of science courses in home economics curricula could have led women to major in science. By providing exposure to science courses, home economics allows enrollees to update their preferences early in their college careers and switch to science if they find they like it. Additionally, because so many courses are cross-listed between home economics and science majors, home economics lowers the costs for women to attempt a science degree since they have the option to switch later into home economics. Finally, and crucially, as both of these channels push more women into biology and chemistry, they generate an intertemporal spillover in which future cohorts believe they are more likely to have success in those fields.

After introducing our data and model, we first show that home economics had a contemporaneous effect on women in science majors. We do this using two datasets. First, we utilize a panel of yearbooks collected from 21 colleges by Andrews (2021a). While roughly the same number of men major in science in colleges with and without home economics programs, female science majors in colleges without home economics are virtually nonexistent. We show that when a college increases the share of women majoring in home economics by 10 percentage points, the share of women majoring in science increases by about 3.5 percentage points. Using information on women's hometowns from the yearbooks, we argue that this effect is unlikely to be driven by women selecting into colleges that are strong in both home economics and science. While double majors are exceedingly rare in our data, female home economics majors are more likely to double major in science than are other female majors.

While the panel dimension of the yearbook data is useful, we have this information for only a few schools. To investigate the relationship between home economics and science in more depth, we conduct cross sectional analysis using the 1910 Commissioner of Education Report, which is the only historical Commissioner of Education report to record enrollment by major and gender for a full set of college majors. When comparing across colleges, we find results qualitatively similar to those in our panel analysis: colleges with ten additional female home economics students are expected to have about one additional female science major. In placebo tests, we find that for no other major does the share of women predict women in science.

The strong effect in land grant colleges is not surprising, given the relationship between home economics and agriculture mentioned above. We exploit this relationship to argue that the effect of home economics on science majors is likely causal, using the size of the male agriculture program as an instrument for the share of women in home economics. The argument is that agricultural departments expanded largely due to changes in federal funding brought about by the Morrill Acts of 1862 and 1890, the 1887 Hatch Act, and the 1914 Smith-Lever Act; home economics programs could "piggyback" off of this land grant funding, even though they were largely an afterthought. Our IV results are similar to our baseline cross sectional results. To ensure that our instrument is not working through other channels, such as the sharing of scientific equipment between agricultural and home economics departments, we take advantage of the fact that the 1910 Commissioner Report includes a wealth of information on colleges' endowments, the value of their scientific apparatuses, teaching disbursements, etc. Controlling for all of these measures of resources does not affect our results. We also show that the size of the male agricultural program does not predict female enrollment in any other majors that could not take advantage of land grant funding.

We also find that counties in which colleges had more women in home economics in 1910 also have a higher share of employed women that work in technical fields in later census years. Thus we have suggestive evidence that exposure to science through home economics affects women's labor market outcomes later in life.

Finally, we present preliminary results showing that colleges with more women in home economics in 1910 also have more women in science in 1965. Consistent with the intertemporal spillovers in our model, we therefore find evidence that exposure to science through home economics in 1910 altered gender attitudes a half century later. By 1965, home economics as a field had become much less scientific. We verify that the share of women in home economics in 1965 does not predict the share of women in science in 1965.

We draw a number of lessons from this study. First, we show that historical cultural movements and education policy decisions can resonate until today; current gender differences across academic fields have their roots in the first decades of the 20th century. Perhaps more worrisome for those interested in eliminating gender gaps across educational fields, it was precisely the aspects of early home economics that were most "rigorous" and "progressive" that led to the perception that biology and chemistry were female fields, while physics and engineering were not. On a more optimistic note, our findings give a dramatic example of what Goldin (2001) refers to as the "virtue" of "general education": by introducing women to subjects from many fields in the early years of their program, home economics opened doors to science that otherwise would have remained closed; a curriculum focused exclusively on practical homemaking skills without forcing students to learn the biological and chemical theories underpinning homemaking would have been unlikely to reshape perceptions about women in biology and chemistry.[2]

This paper is organized as follows: Section 2 provides a brief history of home economics and describes the data used to quantify home economics in the college curriculum and its relationship to science. Section 3 presents a simple model illustrating how home economics could open the gate for women into science and persistently shape gender attitudes towards specific science fields. Section 4 presents results using the panel of college yearbooks. Section 5 presents cross sectional results using the 1910 Commissioner of Education Report. Section **??** shows how the share of home economics in 1910 predicts more recent educational outcomes. Section 6 concludes.

2 Historical Background and Data

We begin by briefly sketching the history of home economics in U.S. higher education, emphasizing how science-intensive its early curriculum was at a time that female college attendance was increasing dramatically.[3] In the process, we also describe the datasets we use in this paper.

2.1 Why Did Home Economics Emerge in the Late-19th/Early-20th Century?

The beginnings of home economics is typically dated to September, 1899, when a conference at Lake Placid, New York, brought together several early luminaries to coin a name for the movement and set an agenda for future years (Dreilinger, 2021; Weigley, 1974). In reality,

[2] Goldin (2001) refers to "virtues" in the context of the American high school movement, but the principle—that openness and a general education allows students to experience more fields and find the best match for their individual skills—applies to first and second year college courses as well.

[3] Two full-length histories of the home economics movement in the U.S., Elias (2008) and Dreilinger (2021), also emphasize its early science focus. We draw on both of those histories throughout.

the formation of home economics was far less centralized, and important precursors took place decades before the Lake Placid Conference. We identify three important factors that led to home economics emerging when and how it did.

First, home economics got a jump start from the promotion of agricultural education in the late 19th century. Public support for agricultural training, best exemplified by the Morrill Land Grant Acts of 1862 and 1890 and the Hatch Act of 1887, represented a sharp break in the history of American higher education and contrasted sharply with the classical liberal arts curriculum practiced at most private colleges. Public land grant institutions were required to provide training in agricultural, mechanical arts, and military training, but these programs almost entirely served men. Creating a new field for women—home economics—provided a way for land grant colleges to further their democratic mission by increasing women's enrollment. Home economics also served a practical purpose, as increasingly sophisticated farmers required increasingly sophisticated wives. As the trustees at Iowa State College put it in 1869, "if young men are to be educated to fit them for successful, intelligent and practical farmers and mechanics, is it not as essential that young women should be educated in a manner that will qualify them to properly understand and discharge their duties as wives of farmers and mechanics?" (Eppright and Ferguson, 1971)

The early leaders of home economics embraced this connection with agricultural training, as it allowed them to benefit from the public resources made available. The 1887 Hatch Act and 1914 Smith-Lever Act were particularly important for securing federal funding, along with state matching grants, for both research and extension work.[4] By classifying home economics as a subject under the broad umbrella of agriculture, early home economists were able to unlock funding from the Hatch and Smith-Lever Acts. As we will demonstrate, federal financial support significantly increased home economics program sizes. In addition to providing direct funding, the US Department of Agriculture (USDA) provided employment opportunities for home economics graduates. The USDA Office of Home Economics opened in 1915, hiring home economists to work alongside agricultural experts (Elias, 2008).

Second, home economics benefited from the pace and direction of technological advances during the Second Industrial Revolution. During the early 20th century, high school attendance increased dramatically, preparing a generation of boys and girls for advanced education (Goldin and Katz, 1999a). Electrification brought labor-saving technologies into the home (Cowan, 1985) and skill-biased job opportunities in the service sector (Goldin, 2006; Gray, 2013; Vidart, 2020). Many of the scientific discoveries from the late nineteenth and early twen-

[4]See Kantor and Whalley (2019) and Andrews (2021b) for recent research evaluating the effectiveness of land grant colleges at producing agricultural research and disseminating it to local communities.

tieth century were directly relevant to homemaking (Mokyr, 2000). The first home economics subject in 1900 was Hygiene and Sanitation (Elias, 2008), certainly not a coincidence given recent breakthroughs in bacteriology. As scientists better understood the germ theory of disease, they also came to realize that many diseases were preventable through better hygiene and sanitation; actually achieving better hygiene and sanitation, however, would require changing behavior inside the home, which required educating the homemakers (Stage and Vincenti, 1997). The second home economics subject, Food and Nutrition, formed in the late 1910s and was integrally linked to the discovery of vitamins and minerals.

Third, home economics was seen as a vehicle to provide both theoretical and vocational instruction to women at the higher education level. The participants at the Lake Placid Conference saw themselves as revolutionaries opening up new horizons for women.[5] They were emboldened to construct a curriculum that would be both practical but also abstract and scientific, but they were not above advertising the program as training for housewives if it would lead to greater resources and enrollment.

2.2 How Scientific Was the Field of Home Economics?

Home economics was thus widely seen as preparation for a purely domestic life, yet the programs had substantial scientific resources available and many early founders were determined to provide a rigorous education. So how scientific was the field of home economics in actuality?

Anecdotally, students who were interested in homemaking complained that the home economics curriculum was too theoretical and not practical enough, but the founders saw rigorous theoretical training as vital for women to access new career paths, since "they cannot all become teachers".[6] We quantify how successful home economists were at introducing rigorous science into their field using two sources: college course catalogs and journal articles published in the Journal of Home Economics. While histories of home economics often stress that the field was science-heavy in its early years (especially Dreilinger (2021)), to the best of our knowledge this is the first attempt to quantify the changing nature of science in home economics.

2.2.1 Course Catalogs

We collected course catalogs from 15 colleges covering the years 1890 to 1953. We selected colleges to correspond to those for which we have data from college yearbooks, described below; for some colleges we were unable to locate historical course catalogs. From the catalogs, we

[5] This is the factor Dreilinger (2021) emphasizes most.

[6] Quoted by Ellen Richards in (McCollough, 1912).

manually transcribed course requirements for the home economics curricula. A sample from an Iowa State course catalog in presented in Figure 1.

From the Iowa State example, the influence of agriculture in the home economics curriculum is apparent. In fact, when Iowa State inaugurated its home economics program, the freshmen year courses for home economics were identical to those for the agriculture major. The sophomore year courses continued to include courses in chemistry and botany (Eppright and Ferguson, 1971). Since agriculture is a multidisciplinary field of biology, students who enrolled in home economics programs were fully exposed to the foundation of biological sciences. Before taking specialized home economics courses, students had to complete courses in chemistry, physiology, and bacteriology. This is typical across programs and is not unique to Iowa State. For example, the 1919 Cornell Catalog shows that women who wished to specialize in home economics must complete the same core courses as men in agriculture, covering biology, chemistry, physics, physiology, and bacteriology. Similarly, at Utah State University in 1911, students in domestic science had to complete courses in general chemistry and plant physiology in their freshman year, as well as courses in bacteriology, advanced physiology, and chemistry in their sophomore year.

Figure 2 shows the share of total required credit hours for the home economics degree over all course catalogs broken out by different subjects. Panel(a) plots eight different fields: chemistry, biology, health, math, engineering, physics, psychology, and finance. For readability, in Panel (b) we plot two larger groups, the first of which consists of biology and chemistry and the second of which consists of math, physics, and engineering. The overall pattern is clear: home economics majors had a surprisingly large share of credit hours in these technical fields, with the share peaking early in home economics' life around 1900, remaining high through 1920, and eventually declining.

A closer examination reveals how the focus of fields has changed over time. As mentioned above, the earliest home economics subjects were related to biology: health and hygiene applied recent knowledge of bacteriology, while food and nutrition built on recent discoveries of vitamins and advanced the frontier of food science. In 1900, more than one out of every three required home economics credit hours was devoted to biology, and more than half were devoted to either biology or chemistry. This share declined to just over 20% by 1950 as the main topics of focus shifted.[7] In the 1930s, home economics training added developmental psychology,

[7]Although life sciences dominated early home economics science requirements, as farming continued to mechanize and electrified household appliances were continuously invented, home economics also began adding courses in household equipment and courses in physics and electric circuits were sometimes required (Bix, 2002). Our data show that home economics curricula always required more biology- and chemistry-related courses than those related to physics or any engineering field, including electrical and mechanical.

possibly in response to the cultural shift in the belief that children deserved protection, nurture, and education. The 1920s, and especially the Great Depression decade of the 1930s, saw the addition of courses on personal finance. While worthy subjects, the shift towards psychology and personal finance reduced home economics' traditional emphasis on biology and chemistry; in later decades, the field would double down on its domestic focus, with science almost entirely disappearing from its curriculum (Dreilinger, 2021). Physics and engineering, while always present, accounted for only a small share of credit hours in all years. Mathematics, on the other hand, was featured prominently in 1900 but declined to very small shares, even lower than physics, by 1920. From these figures, it is therefore not surprising that women who studied home economics, especially before the mid-1920s, would have been very familiar with ideas in biology and chemistry.

2.2.2 Journal of Home Economics

Our second source of information on the scientific content of home economics comes from the Journal of Home Economics, published by the American Home Economics Association from 1909-1993; we collect data from 1909 to 1960.[8] For each article title, we verified whether the title contained a word root matching to a dictionary of terms associated with different scientific fields: biology, chemistry, nutrition, hygiene, psychology, physics, or engineering. In contrast to the course catalogs, which directly documents the courses students must take, the Journal of Home Economics provides information on the research frontier on the field. We expect, however, that researchers' interests should be reflected in the classroom; when home economics scholars are more interested in biological research, for instance, they may emphasize biological topics in general home economics courses that do not reflect "biology" in the course title. One limitation of the Journal of Home Economics articles is that publication only began in 1909, and so we miss the earliest years of the field.

Figure 3 Panel (a) plots the share of all titles that include at least one science-related word, regardless of the field. Consistent with the evidence from the course catalogs, the article titles suggest that home economics was most science-focused in its early years; the highest share of science in the journal articles occurs in the early 1920s. By 1960, only about 4% of article titles include a science-related term. Non-science based articles tend to be focused on

[8]All volumes of the Journal of Home Economics can be accessed from Cornell University's Home Economics Archive: Research, Tradition, History (HEARTH) Digital Collections: https://digital.library.cornell.edu/catalog/hearth4732504.

primary and secondary education, the state of the field, and, in later years, personal finance and economics-related topics.[9]

Panel (b) shows the share of articles separately for the eight scientific fields. Nutrition was almost always the subject of most interest to researchers. As noted above, nutrition drew heavily on knowledge from both biology and chemistry. The next three most prominent fields are biology, chemistry, and hygiene, the latter of which also drew heavily from biology; these three fields account for their largest share of articles prior to 1930. Terms related to physics virtually never appear, and engineering terms are also absent for most years.

Taken together, the Journal of Home Economics and course catalog data paint a consistent picture: home economics was surprisingly scientific, especially before roughly the mid-1920s, and it was particularly focused on biology, chemistry, and applications thereof. In later years, and especially after World War II, the field became less scientific and less concentrated on biology and chemistry.

2.3 How Large Was Home Economics within Higher Education?

Was home economics large enough to expose a large number of college-going women to science? We draw on two data sources to quantify the size of home economics over time: reports from the U.S. Commissioner of Education and college yearbooks.

2.3.1 Commissioner of Education Reports

The U.S. Commissioner of Education published annual reports until 1915, and biennially thereafter until 1957. These reports list self-reported information from each U.S. institution of higher education, including data on enrollment for professional majors. Commissioner of Education reports have been transcribed and used by several previous researchers, including Goldin and Katz (1999b) and Xiong and Zhao (2019).

Figure 4 Panel (a) plots the total number of home economics degrees conferred in several different waves of the Commissioner Reports.[10] While home economics started out small in the early 20th century, it grew rapidly, with enrollment peaking at almost 8,000 students in 1950 before declining thereafter. Panel (b) plots the share of female home economics degrees conferred out of all degrees conferred to women. The share is also the highest in 1950 at

[9]None of our qualitative results are changed if we omit articles discussing the state of the profession or other administrative-related topics, although the share of science-related articles is slightly higher.

[10]While the Commissioner Reports record degrees conferred, the number of students enrolled in a home economics major may be a more relevant statistic, especially if women switch from studying home economics to a science major. The 1910 Commissioner Report includes both degrees conferred and enrollment by major. According to the 1910 Report, the ratio of degrees to enrollment for women is approximately 1:10.

almost 8% of all degrees women earned, although the share also reached about 6% in 1920 before declining slightly in the 1930s and 1940s and increasing again after World War II. In 1910, when the field of home economics was new and many colleges had not yet established programs, less than 1% of female degrees were in home economics, making the leap to 6% in 1920 even more impressive.

Unfortunately, for most years the Commissioner Reports provide counts for "arts & sciences" majors, but do not provide separate numbers for science. Moreover, most years do not separately list enrollment or degrees granted by gender and major. The 1910 Commissioner Report, however, does include enrollment counts of all majors by gender, including science majors by gender. We therefore rely on the 1910 report for many detailed results that show the relationship between home economics and science. The 1910 report contains a total of 583 institutions and provides detailed information on nine majors: classical & general culture, general science, agriculture, household economy (home economics), engineering, education, commerce, music, and fine art.

Figure 5 shows the distribution of majors separately for men and women at different types of institutions in 1910. The relationship between agriculture and home economics is once again on display: at land-grant universities, roughly 20% of men enrolled in agriculture, and 20% of women enrolled in home economics. While agriculture was supposedly a men's field and home economics a women's field, there were a few exceptions. Women constituted 1.7% of agricultural students in 1910, and although home economics was exclusively female in 1910, some men studied home economics in later years.[11] General Science was not a popular major for either gender. However, the share of women in general science (women in general science/total female students) was larger at land-grant colleges (5.4%) than at state colleges (1.5%) or private colleges (3.8%). Men were more likely to major in science in private college (11.4% of men) compare to state (3.5%) or land-grant (4.3%) colleges. Classical education dominated the higher education landscape at private colleges for both men and women.

In addition to data on enrollment, the Commissioner Report of 1910 also includes information on many college characteristics, including location, the number of faculty, founding date,

[11] Elias (2008) suggested that when men enrolled in home economics courses, these were most often institutional management classes, a group of topics that later became the core of hotel management and similar programs. Using Cornell University's yearbooks from 1919 to 1936, we estimate that 95 percent of male students in home economics were indeed majoring in Hotel Management. (See below for information on college yearbooks and Section **??** for results using Cornell's hotel management majors.) However, data from the 1958 *Biennial Survey of Education* provides information on men in home economics programs and does not show a concentration in institution management. Among the 36 bachelor's degrees in home economics conferred to men, there were 2 in general curriculums, 2 in child development and family relations, 3 in clothing and textile, 11 in foods and nutrition, 6 in institution management, and 12 in other unspecified home economics fields.

funding sources, values of various assets, library volumes, tuition costs. For land-grant universities, in particular, teaching expenses on different subjects were reported. We utilize several of these data below.

2.3.2 College Yearbooks

Because detailed information on college majors and gender is only available for 1910, we turn to another source to create panel data on women's major choices. We collect college yearbooks for 21 colleges from ancestry.com; this same set of yearbooks is used in Andrews (2021a). The yearbooks include the names, hometowns, and majors for all students, along with other information such as sports and club participation. Our data cover 305 individual yearbooks from 1879 to 1940 and include records for 83,448 undergraduate seniors. Summary statistics of all colleges appearing in the sample are provided in Table 1.

We grouped home economics majors and science majors to the best of our ability to account for differences in the granularity of major names and formats. We excluded majors in "Arts & Sciences" (or similar variation) since we cannot identify whether these are science majors or not. For this reason, enrollment in science is under-counted, and more so in more recent years due to the increasing number of Arts & Sciences major reported. In our sample, 7 colleges had no home economics enrollments in any year, 5 colleges had positive home economics enrollment for all transcribed years, 9 colleges went from having no enrollment to positive enrollment in home economics.

Figure 6 Panel (a) show the increase in the number of colleges for which we have yearbooks in each year along with the number of those colleges with a home economics program. Panel (b) plots total home economics enrollment over all yearbooks over time. Because we do not have yearbooks for every college in every year, the number of colleges changes from year to year; our panel is unbalanced. In general, coverage becomes more complete in later years, especially around 1940.

While it may be plausible to assume that almost all home economics students are women, this is almost certainly not the case for science majors, and hence we need some way to determine a student's gender. To infer gender, we use first names from the US decennial censuses. More specifically, for each state and each census, we calculate the probability of being male for each first name in the yearbooks, and then impute the inferred gender of the student. A similar technique has been used in, for instance, (Andrews, 2021a) to infer gender and race of patentees, (Cook et al., 2014) to infer race, and (Jones, 2009) to infer age. Using the inferred gender, we can calculate several statistics about women's participation in science.

2.4 A Gateway to Science?

We next present the first suggestive evidence that home economics played a role in bringing women into science fields.

In Figure 7 Panel (a), we plot the fraction of all female students who major in home economics (that is, number of women in science/ total women) for the yearbook sample. We separately plot the colleges that had at least one female home economics students and the colleges that had no home economics in each year.[12] The share of women majoring in science is consistently higher in colleges that have home economics students. In Panel (b), we plot the gender ratio in science, defined as the number of male science majors divided by the total number of science majors. For colleges without home economics, this ratio is very close to one in all years. For colleges with home economics, the ratio is consistently smaller, although there is substantial variation from year to year.

Figure 8 collapses our yearbook data over all years and presents aggregate counts of men and women in science for colleges with home economics and those without. The results highlight the fact that colleges with home economics were not "more science-heavy" per se; the number of men in science is virtually identical in colleges with and without home economics. Instead, home economics is highly predictive only of females majoring in science.

Why did home economics, a discipline typically associated with domesticity, increase women's enrollment in science? The scientific content in early home economics curricula provide an obvious key. For women with little scientific training in primary school and few female scientist role models, their first extended exposure to science may have occurred during home economics programs, with many discovering an interest or aptitude for science. Because a home economics student would take many courses required for majors in chemistry or biology, if she learned that she hated home economics subjects, it would be less costly for her to switch to a science major than to other majors that did not cross-list as many courses.[13] Moreover, home economics prepared women with the necessary skills to go on to medical school or graduate school in science. On the extensive margin, more women who were planning on becoming housewives may have gone to college if home economics was available; once at college they could have

[12]Note that the colleges that belong to each group changes as schools add home economics programs. Results are similar when keeping consistent groupings of colleges, for instance plotting those that always had home economics against those that never had home economics; colleges that added home economics during our sample period initially appear similar to colleges with no home economics but become more similar to the colleges that always had home economics over time.

[13]As long as the switching rate from home economics to science is less than 100%, the existence of this channel will produce a positive correlation between the number of women in home economics and the number of women in science.

been exposed to scientific ideas. Home economics may have encouraged more women to study science even if they never planned on majoring in home economics. Women could attempt a science major and, if they struggled in their introductory courses, switch to major in home economics with a few required classes already completed; the option to switch to home economics could have encouraged women to try science in the first place. Finally, as home economics grew, science-related career opportunities for women increased as well, with home economics graduates working in hospitals, food and consumer goods industries, and the public sector in food testing and regulation positions (Nyhart, 1997); the availability of these positions may have encouraged women to study more science.

Numerous anecdotes to provide evidence for each of these channels. For example, Cassandra Wanzo went to Northwestern University in 1969 and majored in nutrition, a degree offered through the Department of Home Economics. She met all the requirements for a pre-med track and went on to medical school at the University of Wisconsin and became a psychiatrist in Atlanta (Blackwell, 2017). In another case, Reatha Clark King initially chose home economics as a major when she attended Clark College in Atlanta, planning on becoming a high school home economics teacher (possibly until exiting the labor market after marriage, as many women born prior to the 1950s did (Goldin, 2006, 2021)). During her home economics major, Reatha fell in love with science and switched her major to chemistry. She continued her education at the University of Chicago and completed her Ph.D. in thermochemistry, working as a chemist at the National Bureau of Standards and eventually General Mills, where she rose to become vice president (Spangenburg and Moser, 2003).

We formalize these channels in Section 3 below.

3 Theoretical Framework

Our model takes the framework from (Altonji, 1993; Altonji et al., 2012), where we treat choosing a college major as a sequential choice under uncertainty. The model has two period. In period 0, a woman decides whether to get married directly or begin college in either science (s) or letters (l). Later we will introduce a college major choice, home economics (h). While we examine the choice of science and letters, the model could be equivalently thought of as a choice between biology/chemistry and physical science/engineering majors; alternatively, we could have women choose between more than two majors, although this makes the model more cumbersome without changing the intuition.

Women choose whether or not to attend college and her major conditional on attending in order to maximize her ex-ante utility, which is composed of monetary return and taste.

However, she does not know her ability and taste for certain. The field of study influences the mix of s and l taken. For simplicity, assume there were only two majors, letter and science. Knowledge in s and l at the end of a year of college depends on the field chosen and aptitude. [14] At the end of the first period, taste is revealed and an informative signal on their field-specific ability is given. Based on the updated information, a woman may change her field of study or drop out of college. The monetary return to the second period depends on whether she receives a degree and is zero if the the minimum field-specific knowledge requirements for the degree are not met. If she attends college for the second period, she finds out whether she completed the degree requirements at the end of the period. She then goes to work at the appropriate wage or becomes a homemaker.

The stock of knowledge: Let knowledge at the end of college period t be denoted by $K_t = \{K_{st}, K_{lt}\}$, where K_{st} is the science knowledge, K_{lt} is the letters knowledge at the end of t, and $t = 1, 2$ refers to the first period of college and the second (final) period of college, respectively.

Ability: Woman differ in two dimensions of cognitive ability. Let $A = A_s, A_l$, where A_s is science ability and A_l is verbal ability. A_s and A_l are important for the production of K_s and K_l respectively, and unknown to the student when $t = 0$.

Degree requirement: A college degree in science or letters requires that knowledge K_s2, K_l2 exceed a threshold degree requirement. Knowledge accumulation is stochastic, but the probability g_{2c} that a person who is studying in field c in the second year will complete the degree requirements is a positive function of K and A. Science and letters requirements are sufficiently different that students who choose to study in science (letters) in period 1 have a small chance of completing the degree requirements in letters (science).

Preferences: Utility is the sum of the present value of income and a term that depends on a taste parameter j summarizing nonpecuniary preferences for marriage, career and types of career. Type 0 woman dislike school and career sufficiently relative to the difference between Y_{2s}, Y_{2l},Y_1 that they do not receive an increase in utility from completing a degree in science and letters even though they would earn higher wages. Type 1 woman prefer a career in science than in letters. Type 2 woman prefer a career in letters than in science. Type 3 woman prefers college to no college and but is indifferent between a career in science and a career in letters.

Degree requirement: A college degree in field l or s requires that a field specific function of knowledge K_{2l}, K_{2s} exceed a threshold degree requirement by the end of second period. The probability g_{2c} that a person who is studying in field c in the second period will complete the degree requirement is an increasing function of K_{1l}, K_{1s} , A_l, A_s. The relative effect of these

[14] In Altonji (1993), knowledge at the end of a year of college also depends on the knowledge stock at the beginning of the year.

variables on g_{2c} depends on c. Graduating with a degree in c increases with the field-specific knowledge accumulation, and relevant ability. The programs and the requirement for field l and field s are sufficiently different that students who choose to study in field l in the second period have a negligible chance of completing the degree requirement in s, and students who choose to study in field l in the first period have a small chance of completing the degree requirement in s if they switch field after the first period; likewise for those who study s in the first period.

Before attending college, a woman with characteristics X believes that the probability that she is type j is $\theta_j(X)$, where $j = 0, 1, 2$, or 3. A woman learns her preference type after the first year of college. Similarly, a woman with characteristics X believes that the probability that her ability type is type k is $\gamma_k(X)$, where $k = HH, HL, LH$, or LL. E.g., $k = HH$ indicates high ability in both letters and science. A woman learns her ability type after the first year of college.

Earnings: The discount rate is R. The discounted present value of earning is Y_0 for persons who enter the labor market without any college, $Y_1 = Y_0(1+r)/(1+R)$ for individuals who leave school after 1 year of college, $Y_1/(1+R)$ for women who attend college a second year but fail to get a degree, $Y_{2l} = Y_0(1+r_{2l})/(1+R)^{-2}$ for persons with a l degree, $Y_{2s} = Y_0(1+r_{2s})/(1+R)^{-2}$ for persons with a s degree. We assume

$$Y_{2l}, Y_{2s} > Y_1, Y_0 \tag{1}$$

The value of attending the first year of college in the field l or in the field s is

$$V_1(A, \theta, l_1) = \sum_0^3 \theta_j \sum^k \gamma_k E\{V_2(g_2, j, k)|l_1\} \tag{2}$$

or

$$V_1(A, \theta, s_1) = \sum_0^3 \theta_j \sum^k \gamma_k E\{V_2(g_2, j, k)|s_1\} \tag{3}$$

where the expectation is taken over the distribution of g_2 conditional on the choice of field c in the first period.

Given the assumption about preferences, it is optimal for type 0 persons to drop out school and receive Y_1. She may have high ability but her preferences for homemaking are sufficiently strong that her academic ability does not matter, so

$$V_2(g_2, 0) = Y_1 \tag{4}$$

For type 1 individual (who likes a career in science), the value function is the maximum of the return to staying in college in field s and leaving school and receiving Y_1.

$$V_2(g_2, 1) = max\{[g_{2s}Y_{2s} + (1 - g_{2s})Y_1/(1 + R))], Y_1\} \tag{5}$$

For type 2 individual (who likes a career in letters), the value function is the maximum of the return to staying in college in field l and leaving school and receiving Y_1.

$$V_2(g_2, 2) = max\{[g_{2l}Y_{2l} + (1 - g_{2l})Y_1/(1 + R))], Y_1\} \tag{6}$$

Type 3 individual either stays in college and major in l, stays in college and major in s, or drop out and receive Y_1, so

$$V_2(g_2, 3) = max\{[g_{2l}Y_{2l} + (1 - g_{2l})Y_1/(1 + R)), [g_{2s}Y_{2s} + (1 - g_{2s})Y_1/(1 + R))], Y_1\} \tag{7}$$

In the absence of home economics, a woman starts college if

$$max\{V_1(A, \theta, l_1), V_1(A, \theta, s_1)\} > Y_0 \tag{8}$$

She starts college in the field l if the condition in Equation (8) holds and

$$V_1(A, \theta, l_1) > V_1(A, \theta, s_1) \tag{9}$$

Now we introduce the home economics major (h). Recall from our discussion in Section 2 that the first years of a home economics program tended to be extremely science-heavy; we will utilize this fact below. Earnings for a woman who graduates with a degree in h earns $Y_{2h} = Y_0(1 + r_{2h})/(1 + R)^{-2}$ and we assume that

$$Y_{2l}, Y_{2h}, Y_{2s} > Y_1, Y_0. \tag{10}$$

When home economics is introduced to college, the number of women who study s increases through two channels.

Channel 1: Previously, women who are type 0 with large probability may not have gone to college. Because home economics provides homemaking knowledge, these women may choose to go to college and study home economics (h) to increase home production. She will stay in college if she is revealed to be type 0. Equation (4) becomes

$$V_2(g_2, 0) = max\{[g_{2h}Y_{2h} + (1 - g_{2h})Y_1/(1 + R))], Y_1\} \tag{11}$$

Y_{2h} could be thought of as value of home production should a type 0 woman get married with a degree in home economics. Home economics therefore increases total female enrollment. For some of the women who started college with home economics, their true type might revealed to be 1 or 3. If home economics covers enough science courses, knowledge accumulation in science K_{1s} will be comparable to that a woman would have obtained if she studied science in the first period, and g_{2s} would be as high as if she started off in science. In other words, she could switch to science at a low cost.

Channel 2: For women who are career type with large probability, the availability of home economics reduces their cost to starting college in s. In the case that their true types are not science but 0, they can still switch to home economics and graduate with reasonable probability: g_{2h} conditional on starting with science is higher than starting with letters. Especially for those who are pretty indifferent to start college in either major, home economics as a back-up option can push the ex-ante utility to start college with science to be greater than that with letters.

$$V_1(A, \theta, s_1) > V_1(A, \theta, l_1) \tag{12}$$

Intertemporal Spillover: Where does the belief θ_j come from? Boyd and Richerson (1985) show that in situations such as ours where it is costly for individuals to acquire information about their type, it can be optimal to rely on heuristics and rules of thumb. One plausible heuristic is to use the previous cohort's distribution for college attendance and major choice to form ex ante beliefs. In fact, data suggests this is plausible; for example, Goldin (2021, pg. 124-125) cites survey results from the National Longitudinal Survey of Young Women and National Longitudinal Survey of Youth and finds that the share of young women who believed they would be in the labor force at age 35 is almost identical to the share of women whose mothers were in the labor force at the time of the survey.

In our context, this logic means that when home economics is present and more women choose to major in s, this not only affects the current cohort, but raises θ_1 and θ_3 for successive cohorts. In this way, our model can deliver intergenerational transmission of beliefs and lead to the creation of a "typical" career path for women.

4 Panel Analysis with Yearbook Data

In this section, we analyze whether a larger share of women in home economics majors in our yearbook sample predict more female science majors. Because we have a panel of yearbooks, we exploit changes in the relative sizes of home economics programs within a college at different points in time. More specifically, we estimate the following:

$$WomenInScience_{ct} = \beta WomenInHomeEconomics_{ct} + X_{ct}\alpha + College_c + Decade_t + \epsilon_{ct} \tag{13}$$

where $WomenInScience$ is some measure of the relative number of female science majors, $WomenInHomeEconomics$ is a measure of the relative number of female home economics majors, X_{ct} is a vector of college-year-specific control variables, $College_c$ is a college fixed effects, and $Decade_t$ is a decade fixed effect. We use a decade fixed effect rather than a year fixed effect because our panel is unbalanced and in many cases only a small number of colleges may have a yearbook in a given year. The college-year-specific controls in all specifications are the total number of students and total number of female students at college c in year t.

We present results for several different measures of $WomenInScience_{ct}$ and $WomenInHomeEconomics_{ct}$ in Table 2. In our baseline specification in Column 1, we use as our main explanatory the share of women majoring in home economics and as our dependent variable the share of women majoring in home economics. More specifically, we define $ShareWomenInHomeEc = \frac{Num.WomenHomeEcMajors}{Num.TotalFemaleStudents - Num.WomenScienceMajors}$. We subtract the number of female science majors from the denominator because otherwise the share of women majoring in home economics and science would be mechanically related (since the shares must sum to one). Likewise, we define $ShareWomenWhoMajorInScience = \frac{Num.WomenScienceMajors}{Num.TotalFemaleStudents - Num.WomenHomeEcMajors}$. Column 1 shows that increasing the share of women majoring in home economics predicts a higher share of women majoring in science.

The model in Section 3 shows that home economics may affect women's major choice even for women who do not choose to major in home economics. For that reason, in Column 2 we estimate an extensive margin regression to test whether the share of women majoring in science increases when a college establishes a home economics program, regardless of the size of that program.[15] The main dependent variable, $HasHomeEcProgram$, is an indicator equal to one if college c has at least one home economics student in year t. After establishing a home

[15] This is a crude test of this channel, since a small home economics program may be highly selective or not very attractive and, in either case, not be a good outside option for women who attempt a science major.

economics program, the share of women majoring in home economics increases by about 1.8 percentage points, or about 15%, although this increase is imprecisely estimated. In Column 3 we include both the continuous share of women majoring in home economics and the extensive margin indicator in the same regression. The share of women in home economics continues to predict a large share of women in science, but the extensive margin indicator is now negative and larger in magnitude than before, although still statistically significant. We view this as suggestive evidence that the indirect channels are not particularly important.

In Columns 4-6, we repeat the analysis in Columns 1-3 but use as our dependent variable the fraction of science majors that are female, $FractionScienceMajorsThatAreFemale = \frac{Num.WomenScienceMajors}{Num.TotalScienceMajors}$. Results are qualitatively similar to those in the first three columns: a larger share of women majoring in home economics predicts more women relative to men in science. In both Columns 5 and 6, the extensive margin indicator is positive but statistically insignificant.

In Columns 7-9, we use the number of women majoring in home economics as the main explanatory variable and the number of women majoring in science as the main dependent variable. In these columns, all results are statistically insignificant, although the signs go in the expected direction and magnitudes are plausible: one hundred additional female home economics majors predicts about 1.2 additional female science majors.

4.1 Selection of Women into Colleges with Large Home Economics Programs

If university home economics and science departments can share resources (e.g., laboratory equipment), then schools that are good at science may also be good at home economics, and hence our results above could be driven by self selection of students rather than the exposure effects or any of the other channels outlined in Section 3. To address this concern, we repeat the results in Table 2 but focus on a set of women that is unlikely to have selectively chosen their colleges. One unique feature of the college yearbook data is that they often report students' hometowns. Numerous studies have argued that transportation costs to a college are a significant barrier to attendance, and hence students are much more likely to attend local colleges; frequently proximity to a college is used as an instrument for attendance (Card, 1995, 2001; Russell et al., 2021). We therefore estimate the effect of the share of women in home economics on the share of women in science when restricting attention to students who are from the same state as the college.[16]

We present results in Table 3. In all columns, results are qualitatively similar to those in Table 2, although sample sizes are smaller since we do not have hometown information in all yearbooks and hence some results are no long statistically significant at conventional levels. Overall, however, we view these results as broadly consistent with a negligible role for self selection of students to colleges.

4.2 Double Majors

In the previous sections, we show that when a college gets more women in home economics majors, it also gets more women in science majors. We interpret this as evidence that exposure to science in home economics programs changes women's preferences and induces them to switch to a science major. Instead of switching to science majors, women in home economics programs may simply add a science major to their home economics degree, especially if many science classes fulfill requirements for both majors. Unfortunately, double majoring is exceedingly rare in the yearbook data, and so we cannot conduct a statistical test to see if home economics majors are more likely to double major in science than are students with other majors, but the raw data is consistent with this view.

While we observe a total of 56,314 undergraduates' declaration of majors, only 648 (1.15%) undergraduates enrolled in more than one major. The percentage (2.7%) is higher for students in Home Ec: out of 5,179 students in Home Ec, 140 had a second major. Among the double-majors, 45 (32%) paired with sciences, while the next highest double major was 29 (20%) pairing with education.[17] In comparison, 171 out of 5,633 (3%) students who majored in education had a second major. Only 6 students (3.5%) had a double-major in science. [18]

5 Cross Sectional Analysis with 1910 Commissioner of Education Report

In this section, we test for a relationship between the relative size of women in home economics and women in science using the cross section of colleges in the 1910 Commissioner of

[16] In ongoing work, we will restrict attention to students from the same town or county as their college. This step requires cleaning hometown names from the yearbooks.

[17] With this small number of science double majors, we can examine the exact name for the paired major. 35 home economics majors doubled in general science, 3 in industrial science, 1 in science, 5 in chemistry, and 1 in zoology.

[18] 1 double majored in botany, 2 in chemistry, 1 in medicine, 1 in physiology, and 1 in pharmacy.

Education report. We estimate

$$WomenInScience_c = \beta WomenInHomeEconomics_c + X_{ct}\alpha + \epsilon_c. \tag{14}$$

In contrast to our estimates in Section 4, here our variation comes from differences across colleges in the same year. However, the 1910 Commissioner report contains many more colleges than are available in the yearbook data.

We present results using all 1910 colleges in Table 4.

5.1 Placebo Tests

We show that this relationship between home economics and science is, indeed, unique to home economics. We re-estimate the cross sectional correlations but use the share of women in the most common non-home economics majors for women: classics, music, education, fine art, and commerce. Results are presented in Table 5. In no cases do these other majors significantly predict more women in science, although several predict fewer women in science that is statistically significant at the 5% or 10% level.

In Column 7 of Table 5, we also show that more women in home economics does not predict more men in science. This ensures that our results are not simply detecting a relationship between larger home economics programs and larger overall science programs.

5.2 The Land Grant Sample

As discussed in Section 2, home economics had a special relationship to agricultural education, often being housed in agricultural colleges and sharing first year curricula with the agriculture majors. The colleges that had the most prominent commitment to agricultural education were the land grant colleges. In Table 6, we repeat the analysis in Table 4 but restrict attention to the sample of land grant colleges. We find results that are even larger in magnitude, although of the same sign and direction, than those in our full sample.

Restricting attention to the land grant colleges removes a large number of colleges that had no home economics programs (and often very small or nonexistent science programs as well). Even though all land grant colleges were encouraged to provide home economics education, there is still substantial variation in the size or even existence of home economics in the land grant colleges in 1910, which allows us to estimate the results in Table 6. We further exploit this variation below.

5.3 Agriculture Instrument

As discussed in Section 2, the USDA contributed to the development of home economics by including it as an agricultural subject for the purposes of federal funding. Thus, in-state demand for agricultural education likely correlated with resources available for home economics. Specifically, a higher in-state demand for agricultural education led to a larger agriculture program; since home economics shared the same funding sources with agriculture, a larger agriculture program meant a lower marginal cost to invest in a home economics program. Home economics programs were often part of schools of agriculture, home economics research was conducted at the Agricultural Experiment Stations, and collaborations between home economics faculty and agriculture faculty were common (Smith, 1933). Building off these observation, we use the number of men in agriculture program as an instrument for the number of women in home economics. The identifying assumption is that agricultural funding is allocated to support agricultural program research and is independent of colleges' home economics programs and that the size of the agricultural program affects women in science only by providing additional funding for home economics.

Before turning to the 2SLS results, we will examine the first stage relationship in our land-grant sample. Columns 1&2 of table 7 show the coefficient on the instruments in predicting the home economics program size in 1910. The relevance assumption is satisfied as colleges with larger agricultural programs had larger home economics programs. Figure 9 visualizes the relationship. Unfortunately, 1910 was still early for some colleges to establish a home economics program. For instance, Cornell University's large home economics school that pioneered the Hotel Management program did not begin until 1919.[19] Hence, our instrument worked better at the intensive margin than the extensive margin. Because sizes of the agriculture program only explain a proportion of variation in sizes of the home economics program (when home economics program had been established), the F-stat is small and our 2SLS estimates would be biased towards OLS estimates given the small sample (Bound et al., 1995).

The credibility of our research design hinges on the assumption that demand for agriculture did not affect women in science directly or indirectly for reasons other than providing resources for home economics. The exclusion restriction is challenged if the relevance of agricultural education, whose variation could be attributed to the adoption of agricultural technology, increases the demand for science education. To rule out this possibility, we regress agricultural program

[19] Home economics began as a department in the College of Agriculture at Cornell. In 1919, Cornell's trustees made it the School of Home Economics (Engst and Friedlander, 2014). From Cornell's yearbooks, we first observe seniors majoring in Home Ec in 1919.

sizes on different measures of science available in the 1910 Commissioner Report: the number of men in general science, teaching expenses on science, and the value of scientific apparatus. Table 8 presents the results and shows that no strong correlation existed. In contrast, we found a significant reduced-form relationship between sizes of the agricultural program and the number of women in general science (Table 7 columns 3&4).

Now we turn to quantify the marginal effect of Home Ec program size on women's enrollments in general science in the second stage. Table 9 presents the estimates in 2SLS (columns 1-2). The results are robust to controlling for university scale measures and science-related conditions. Our instrument proved to be relevant, and the second-stage results are larger than the cross-sectional estimates: the spill-over ratio from Home Ec to general science is approximately 10: 1 according to the OLS estimation and 6.5: 1 according to the 2SLS estimates.

The discrepancy between IV and OLS estimates point to the fact that home economics program sizes could be correlated with omitted variables that are negatively associated with women's enrollment in general science, resulting in a downward bias in the OLS estimates. This suggests that if anything there is a negative bias in the selection of home economics programs with respect to women's scientific pursuit. This accords with the narrative evidence which indicates that the design for home economics was motivated by ideas about traditional gender roles and targeted women from rural areas (Schwieder, 1986). The bias could occur, for instance, if prior to the college entrance, a woman (or her parents) who chose the home economics major had a lower level of interest in science than another woman who chose the major in music or classics.

The analysis in this section offers two distinct advantages. First, although home economics education was a signature of land-grant universities, the instrument explains the variation in sizes of the home economics program within the land-grant sample. Second, the empirical design allows us to assess the plausibility of the identification strategy more easily. Since agricultural education was almost exclusively male[20] and has specific motivated origins that are bound to geological conditions and factor prices,[21] it should have little organic connection with women in higher education other than the arbitrary Home Economics-Agriculture bundle assigned by the USDA. We therefore argue that the relationship between home economics and science is plausibly causal.

[20] 98.3% of agriculture degrees were awarded to men in 1910.

[21] For example, Manuelli and Seshadri (2014) attributed the variation in horse prices for the case of tractor adoption.

5.4 Labor Market Results

Does home economics affect women's engagement with science even after they have finished college? Using the full sample of colleges in the 1910 Commissioner of Education Report, we can study whether more women studying home economics predicts labor force participation or science-related occupations later in life.[22] It is ambiguous whether we should expect home economics to lead more women into the labor force. While home economics majors provided women with skills that are relevant to the labor market, including in science, they also taught women how to be better housewives, increasing their value on the marriage market and allowing them to more easily find high-earning husbands so that they did not have to work. As Cowan (1985); Mokyr (2000); Ramey and Francis (2009) argue, training to become a better housewife in the early 20th century often led to "more work for mother" and less time for mother to spend in the labor market.

Data on female labor force participation is available for 1920, 1930, and 1940 (the three U.S. decennial population census years administered after the 1910 Commissioner of Education Report) are available from Ruggles et al. (2021). The 1910 Commissioner of Education Report includes students who would have graduated in 1910, 1911, 1912, 1913, or 1914; if we assume that all students graduated when they were 21 years old, then these women would have been 27-31 years old in 1920, 37-41 years old in 1930, and 47-51 years old in 1940. We observe labor force participation rates for women of those ages in each county with at least one college in the 1910 Commissioner Report. More specifically, we estimate

$$FemaleLaborForceParticipationRate_{ct} = \beta HomeEconomicsShare_{c,1910} + X_{c,t}\alpha + Year_t + \epsilon_{ct}, \tag{15}$$

where $HomeEconomicsShare_{c,1910}$ is the share of non-science female students who major in home economics in the 1910 Commissioner Report as in **Column X of Table Y** in county c, $FemaleLaborForceParticipationRate_{ct}$ is the labor force participation rate for women who were plausibly in the 1910 Commissioner Report in county c and census year t, X_{ct} is a set of control variables, and $Year_t$ is a fixed effect for the decennial census year in which the female

[22] We also replicated the results in this section using the college yearbook data in Section 4. Results are not statistically significant and are highly sensitive to functional form and sample restrictions. This sensitivity is not surprising, given that the yearbook sample consists of a small number of colleges; these colleges contain a relatively small share of the total number of college students; in each college there is relatively little year-to-year variation in the number of college seniors in any given major; and we do not know each individual's exact age at graduation. We therefore believe the 1910 Commissioner of Education Report provides a better setting to study this question.

labor force participation rate is observed. This is a demanding specification, since college educated women make up a small share of each cohort. Moreover, college-educated individuals tend to be highly geographically mobile (Bound et al., 2004; Zolas et al., 2015) and hence may not be living in the counties in which they obtained their degree, introducing substantial measurement error.

Results are presented in Columns 1-3 of Table 10. In Column 1, we include a state fixed effect but no other control variables. Column 2 includes control variables related to the college in 1910: the size of the total student population and the number of female students. Column 3 includes control variables related to the county in each year t: total county population and the share of men in technical occupations; we caution that these county controls are determined after the women obtained their educations in 1910 and hence may be endogenous to the share of women majoring in home economics. In all three specifications, the relationship between the share of women majoring in home economics and the female labor force participation rate is imprecisely estimated and small in magnitude.

While the prediction of whether home economics should lead to higher female labor force participation rates is ambiguous, we should unambiguously expect that exposure to technical skills (including science skills) will lead to technical occupations for those that do enter the labor market. In Columns 4-6, we repeat the specifications in Columns 1-3 but use the fraction of employed women who work in technical occupations as the dependent variable. A "technical occupation" is any occupation that is classified as "Professional, Technical" or "Professors and Instructors" according to the occ1950 code (Manson et al., 2020; US Bureau of the Census, 1950). In all three specifications, we find that women in the labor market are more likely to be in technical occupations in counties with a larger share of female students majoring in home economics.

In Appendix Tables A1 and A2, we repeat several of the above analyses while examining labor market outcomes. In particular, we find similar results when restricting attention to counties that had a land grant college. We also repeat the results while instrumenting the share of home economics majors in 1910 using the share of men in agriculture; while results are imprecisely estimated, they are qualitatively similar and even larger in magnitude than the OLS results.

6 Conclusion

In this paper, we study a historical pattern on American women's participation in science. Specifically, we argue that Home Ec programs expanded women's enrollment in science. We first present cross-sectional evidence between the size of Home Ec program and women's general science enrollment in 1910. We focused on the sample of land-grant universities because of their comparable institutional setup and academic standards. To generate exogenous variation in Home Ec enrollment, we use the demand for agricultural education as a source of identification. The empirical evidence supports the idea that exposure to the Home Ec curriculum increased women's participation in science.

The snapshot in 1910 captured a point in time when hygiene and sanitation was the central theme in Home Ec. This theme developed in the context of the prevailing germ theory and incorporated science courses such as bacteriology as its theoretical foundation. There was no evidence to suggest that women in Home Ec took a watered-down version of the science courses. Since Home Ec departments borrowed physical science courses from natural science departments or agricultural schools, Home Ec students were taught and evaluated in the same standard as their male classmates. Moreover, there was an incentive in the founding days to establish a rigorous scientific standard, as Home Ec strove for academic legitimacy.

We complement the cross-section analysis with a short run panel study on the opening of new Home Ec programs. Compared to when Home Ec was not available, the presence of Home Ec led to a higher proportion of women choosing a major in science and a substantial reduction in the science gender gap. Given that the Home Ec movement quickly spread to other private colleges and state universities, [23] extrapolating the panel estimates would imply a reasonably broad impact on women's entry into science.

Besides serving as a back door to science, Home Ec also invented important subfields in science. The first subfield is nutrition (or food science), the study of chemical substances relating to food. Students who graduate from food science can find employment as dietetics or food technologist. The second subfield is developmental science, the study of child behaviors and development. As Home Ec gradually phased out, developmental science became an integral branch in psychology.

Today, the Home Ec program is arguably irrelevant in the academic domain. In rare cases where this program continued, they are rephrased as either "Human Ecology" or "Family and Consumer Science." The Home Ec legacy is easy to overlook. Our paper examines the unique circumstances that gave rise to Home Ec, and highlights its relation to physical and biological sciences. This short-lived college program may have a long term consequence in women's fair representation in science today.

[23] The number of Home Ec programs increased from merely 68 in 1910 to 340 by 1970.

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Tables

Table 1: Yearbook Data Summary Statistics

College	Students Mean	Women Mean	Students in HomeEc Mean	Women in Science Mean	Yearbooks Num.	Yearbooks First	Yearbooks Last
Auburn University	343.88	66.13	25.25	0.63	8	1916	1940
Clemson University	238	23.6	0	1.8	5	1915	1940
Cornell University	732.53	260.79	20.5	11.74	38	1897	1936
Georgia School of Technology	274	44.18	0	0.53	17	1917	1940
Iowa State University	372.1	169.52	91.03	9.62	29	1905	1940
Louisiana State University	675.29	234	12.86	2.86	7	1927	1940
Missouri University of Science and Technology	74.42	27.08	0	0	12	1911	1940
North Carolina Agriculture and Technology	100	32	4	5	1	1939	1939
North Dakota State University	239	95.53	25.29	1.94	17	1908	1940
Texas Tech	378.5	163.5	50	2.5	2	1937	1940
University of Arizona	213.67	95.56	0	0	9	1913	1940
University of Colorado	218.93	100.78	0	0	27	1893	1939
University of Maine	208.76	83.88	8.12	5.36	25	1904	1940
University of Missouri	457.27	220.77	0.5	0.37	30	1905	1940
University of Nevada	74	28.57	3.71	2.86	7	1901	1940
University of New Hampshire	292.85	97.77	2.46	0	13	1909	1940
University of North Dakota	203.4	69.2	0	0	5	1906	1940
University of Washington	553	171	70	8	1	1940	1940
Utah State University	181.6	52.8	22.6	0.2	5	1911	1939
Virginia Tech	133.33	23.39	0	0.22	18	1898	1939
Washington State University	346.64	112.36	43.27	4	11	1903	1939

Notes: This is a list of colleges for which yearbooks are transcribed. For each college, we list the average number of students, average number of women, average number of students in Home Ec, average number of women in science with matched first names. Also listed is the total number of yearbooks transcribed, the earliest and the most recent transcribed yearbook

Table 2: Home Economics and Science Majors from the Yearbook Sample

	Share of Women Who Major in Science			Fraction of Science Majors that Are Female			Number of Female Science Majors		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Share Women in Home Ec	0.350*		0.394*	0.286**		0.261*			
	(0.188)		(0.207)	(0.113)		(0.122)			
Total College Students	0.000100	0.00000772	0.0000945	-0.000194	-0.000242	-0.000190	0.000185	-0.000270	0.000207
	(0.0000592)	(0.0000728)	(0.0000591)	(0.000141)	(0.000139)	(0.000134)	(0.00213)	(0.00192)	(0.00195)
Total Female Students	-0.000639**	-0.000433*	-0.000622**	-0.000328	-0.000214	-0.000336	0.000731	0.00407	0.000697
	(0.000269)	(0.000206)	(0.000271)	(0.000192)	(0.000287)	(0.000200)	(0.00444)	(0.00479)	(0.00425)
Has Home Ec Program		0.0183	-0.0395		0.0809	0.0273		0.163	0.0596
		(0.0200)	(0.0226)		(0.0475)	(0.0439)		(0.594)	(0.615)
Number of Female Home Ec Majors							0.0122		0.0121
							(0.0115)		(0.0114)
Observations	191	191	191	138	142	138	197	197	197
Adj. r^2	0.700	0.659	0.701	0.680	0.672	0.678	0.670	0.666	0.668
Mean Dep. Var. Rate	.122	.122	.122	.208	.208	.208	2.313	2.313	2.313

Standard errors in parentheses
* p¡0.10, ** p¡0.05, *** p¡0.010

Notes: The table reports estimates on the panel of yearbooks. An observation is a college in a particular year. The dependent variable for columns 1-3 is the share of non-home economics female students who major in science. The dependent variable for columns 4-6 is the number of female science majors divided by the number of all science majors. The dependent variable in columns 7-9 is the number of female science majors. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3: Home Economics and Science Majors from the Yearbook Sample: Local Students

	Share of Women Who Major in Science			Fraction of Science Majors that Are Female			Number of Female Science Majors		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Share Women in Home Ec	0.299		0.338	0.285**		0.237*			
	(0.198)		(0.217)	(0.116)		(0.122)			
Total College Students	0.000163*	0.0000642	0.000160*	-0.000210	-0.000262	-0.000209	0.000291	-0.0000379	0.000357
	(0.0000819)	(0.0000934)	(0.0000827)	(0.000138)	(0.000155)	(0.000135)	(0.00287)	(0.00243)	(0.00274)
Total Female Students	-0.000848**	-0.000617**	-0.000829**	-0.000387	-0.000246	-0.000392	0.00217	0.00428	0.00204
	(0.000358)	(0.000261)	(0.000365)	(0.000320)	(0.000449)	(0.000319)	(0.00715)	(0.00540)	(0.00691)
Has Home Ec Program		0.0162	-0.0356		0.103*	0.0515		0.224	0.171
		(0.0206)	(0.0245)		(0.0504)	(0.0477)		(0.435)	(0.447)
Number of Female Home Ec Majors							0.00760		0.00711
							(0.0123)		(0.0126)
Observations	188	189	188	135	141	135	197	197	197
Adj. r^2	0.691	0.638	0.692	0.649	0.647	0.648	0.634	0.634	0.633
Mean Dep. Var. Rate	.128	.128	.128	.211	.211	.211	1.961	1.961	1.961

Standard errors in parentheses
* p¡0.10, ** p¡0.05, *** p¡0.010

Notes: The table reports estimates on the panel of yearbooks. An observation is a college in a particular year. The dependent variable for columns 1-3 is the share of non-home economics female students who major in science. The dependent variable for columns 4-6 is the number of female science majors divided by the number of all science majors. The dependent variable in columns 7-9 is the number of female science majors. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 4: Home Economics and Science Majors from the 1910 Commissioner Report: All Colleges

Women in Science	Full Sample	Full Sample	Full Sample	Land grant Sample
Women in HomeEc	0.0444**			0.0928***
	(0.0211)			(0.0220)
Women in Classics		-0.0019		-0.0090
		(0.0068)		(0.0130)
Women in Education			-0.0020	-0.0181
			(0.0098)	(0.0260)
Land grant status	Y	Y	Y	N
public funds	Y	Y	Y	Y
private funds	Y	Y	Y	Y
Size	Y	Y	Y	Y
Men in Science	Y	Y	Y	Y
Female College	Y	Y	Y	Y
State fixed effects	Y	Y	Y	N
Observations	578	578	578	42
R^2	.1	.1	.1	.42

Notes: The table reports OLS estimates. An observation is a college in 1910. The dependent variable is the number of degrees in general science conferred to women. Women in home ec/classics is the number of degrees in general science conferred to women in home economics/classics. Number of majors is the total number of majors offered at the college. Scientific apparatus measures the value of scientific apparatus and teaching expenses on sciences measures the disbursement of funds on the teaching of natural sciences. Men in science equals to the number of degrees in general science conferred to men. Total faculty/books/endowment are measured in logarithm. Funds from public sources equals the amount of funds from state, federal government in logarithm. Funds from private sourses is measured in logarithm. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 5: Placebo Majors and Science from the 1910 Commissioner Report

#graduates in:	Women in science						Men in science
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Classics	-0.0282**						
	(0.0116)						
Music		-0.1097*					
		(0.0569)					
Education			-0.0389*				
			(0.0224)				
Fine Art				-0.0725			
				(0.0579)			
Commerce					0.1368		
					(0.2938)		
Household Economy						0.0896***	-0.0126
						(0.0203)	(0.0993)
Fundings	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Men in science	Yes	Yes	Yes	Yes	Yes	Yes	No
Women in science	No	No	No	No	No	No	Yes
Number of majors	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	48	48	48	48	48	48	48
R^2	.39	.36	.35	.53	.31	.33	.28

Table 6: Home Economics and Science Majors from the 1910 Commissioner Report: Land Grant Universities Sample

Women in general science				
	(1)	(2)	(3)	(4)
Women in home ec	0.0993***	0.0808***	0.0986***	0.0996***
	(0.0205)	(0.0196)	(0.0216)	(0.0218)
Women in classics	-0.0095	-0.0164	-0.0072	-0.0099
	(0.0128)	(0.0121)	(0.0138)	(0.0132)
Number of majors	2.8443***	2.6917***	2.6224**	2.8599**
	(1.0317)	(0.9848)	(1.1604)	(1.0580)
Total students	-0.0024	-0.0053	-0.0037	-0.0022
	(0.0025)	(0.0035)	(0.0041)	(0.0027)
Scientific apparatus		4.1025		
		(3.1748)		
Teaching expenses on science		28.5038		
		(25.4913)		
Men in science		0.1042***		
		(0.0346)		
Total faculty			1.8801	
			(3.3518)	
Total books			-0.3537	
			(2.9093)	
Total endowment			-0.1536	
			(0.6598)	
Funds from public sources				-0.2365
				(1.0022)
Funds from private sources				-0.0520
				(0.3969)
Observations	47	47	47	47
R^2	.48	.61	.49	.48

Notes: The table reports OLS estimates. An observation is a land grant college in 1910. The dependent variable is the number of degrees in general science conferred to women. Women in home ec/classics is the number of degrees in general science conferred to women in home economics/classics. Number of majors is the total number of majors offered at the college. Scientific apparatus measures the value of scientific apparatus and teaching expenses on sciences measures the disbursement of funds on the teaching of natural sciences. Men in science equals to the number of degrees in general science conferred to men. Total faculty/books/endowment are measured in logarithm. Funds from public sources equals the amount of funds from state, federal government in logarithm. Funds from private sourses is measured in logarithm. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 7: Men in Agriculture and Women in Science: First Stage & Reduced Form

	Women in home ec	Women in home ec	Women in general science	Women in general science
Men in Agriculture	0.1687*	0.1906**	0.0336**	0.0294*
	(0.0943)	(0.0934)	(0.0155)	(0.0146)
University Size Controls	Yes	Yes	Yes	Yes
Science related Controls	No	Yes	No	Yes
Observations	48	48	48	48
$F-stat$	4.88	3.77		
R^2			.23	.4

Notes: The table reports OLS estimates. An observation is a land grant college in 1910. The dependent variables in columns 1&2 are the number of degrees in home economics conferred to women. The dependent variables in columns 3&4 are the number of degrees in general science conferred to women. University size controls include the total number of majors offered and the total number of degrees conferred at the college. Science related measures include the value of scientific apparatus, teaching expenses on natural sciences, and the number of degrees in general science conferred to men. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 8: Placebo Test of Instrumental Variable on Various Outcomes

	Men in science	Teaching expenses on science	Scientific apparatus
Men in Agriculture	0.0322	1.0531	252.3759
	(0.0554)	(5.2379)	(174.4870)
University Size Controls	Yes	Yes	Yes
Funding Controls	Yes	Yes	Yes
Observations	48	48	48
R^2	.17	.11	.8

Notes: The table reports OLS estimates. An observation is a land grant college in 1910. The dependent variable in column1 is the number of degrees in general science conferred to men. The dependent variable in column2 is the teaching expenses on natural sciences. The dependent variable in column3 is the value of scientific apparatus. University size controls include the total number of majors offered and the total number of degrees conferred at the college. Funding controls include the amount of money received from public and private sources. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 9: Home Economics and Science Majors from the 1910 Commissioner Report: IV Estimates

Women in general science				
	(2SLS)	(2SLS)	(OLS)	(OLS)
Women in home ec	0.1993**	0.1544**	0.1035***	0.0957***
	(0.0897)	(0.0652)	(0.0197)	(0.0194)
University Size Controls	Yes	Yes	Yes	Yes
Science related Controls	No	Yes	No	Yes
Observations	48	48	48	48
$F - Stat$	4.88	3.77		
R^2			.48	.59

Notes: The table reports 2SLS and OLS estimates. An observation is a land grant college in 1910. The dependent variable is the number of degrees in general science conferred to women. Women in home ec is the number of degrees conferred to women in home economics. University size controls include the total number of majors offered and the total number of degrees conferred at the college. Science related measures include the value of scientific apparatus, teaching expenses on natural sciences, and the number of degrees in general science conferred to men. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 10: Home Economics and Labor Market Outcomes

	Female Labor Force Participation Rate			Share of Women in Technical Occupations		
	(1)	(2)	(3)	(4)	(5)	(6)
Female Home Ec. Rate	0.000244	-0.00000310	0.0000839	0.000521***	0.000383***	0.000218**
	(0.000261)	(0.000202)	(0.000116)	(0.0000751)	(0.0000855)	(0.0000952)
Observations	4350	4350	4350	4342	4342	4342
Adj. r^2	0.0413	0.503	0.590	0.0247	0.133	0.157
College Controls	No	Yes	Yes	No	Yes	Yes
County Controls	No	No	Yes	No	No	Yes
Mean Dep. Var. Rate	.195	.195	.195	.036	.036	.036

Standard errors in parentheses

* p¡0.10, ** p¡0.05, *** p¡0.010

Notes: The table reports OLS estimates. An observation is a county in 1920, 1930, or 1940. The dependent variable is the number of degrees in general science conferred to women. Women in home ec is the number of degrees conferred to women in home economics. University size controls include the total number of majors offered and the total number of degrees conferred at the college. Science related measures include the value of scientific apparatus, teaching expenses on natural sciences, and the number of degrees in general science conferred to men. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Figures

Figure 1: The Iowa State Home Economics Curricula

(a) Freshman Year

UNIFORM FRESHMAN YEAR

Fall Quarter	Credits[2]	Winter Quarter	Credits	Spring Quarter	Credits
Elementary Design A.A. 104[1]	2	Elementary Design A.A. 105	3	Household Equipment H Eq. 154	3
General Chemistry Chem. 105	4	General Chemistry Chem. 106	4	†General Physics Phys 106	4
Composition Engl. 101	3	Composition Engl. 102	3	‡Composition Engl. 103	3
Health Education Hyg. 104	3	Textiles T.&C. 104	3	Biology Zool. 104	3
Introd. to Social Sciences Hist. 211	3	Introd. to Social Sciences Hist. 212	3	Introd. to Social Sciences Hist. 213	3
Physical Education Phys.Ed. 121	R[3]	Physical Education Phys.Ed. 122	R	Physcial Education Phys.Ed. 123	1*
	15		16		17

In addition to the courses listed above, each student will be required to include in his schedule: H.Ec. 101, 102, 103. Psych. 110 and Library 106B make up the requirement of H.Ec. 101 in the Fall quarter.

(b) Sophomore-Junior Year

SOPHOMORE YEAR

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Food Preparation F.&N. 204	4	Food Preparation *F.&N. 205	4	Human Physiology Zool. 255	5
Applied Organic Chem. 264	5	Food Chemistry Chem. 265	5	Physiol. & Nutr. Chem. Chem. 275	5
Principles of Economics Ec. 211	3	Principles of Economics Ec. 212	3	Ec. of Consumption Ec. 213	3
Costume Design T.&C. 144	3	House Planning A.A. 260	2	Interior House Design A.A. 264	3
		Early 19th Century Engl. 254 or Technical Journalism T.Jl. 225B	3		
Physical Education Phys.Ed.221	R	Physical Education Phys.Ed. 222	R	Physical Education Phys.Ed. 223	1**
	15		17		17

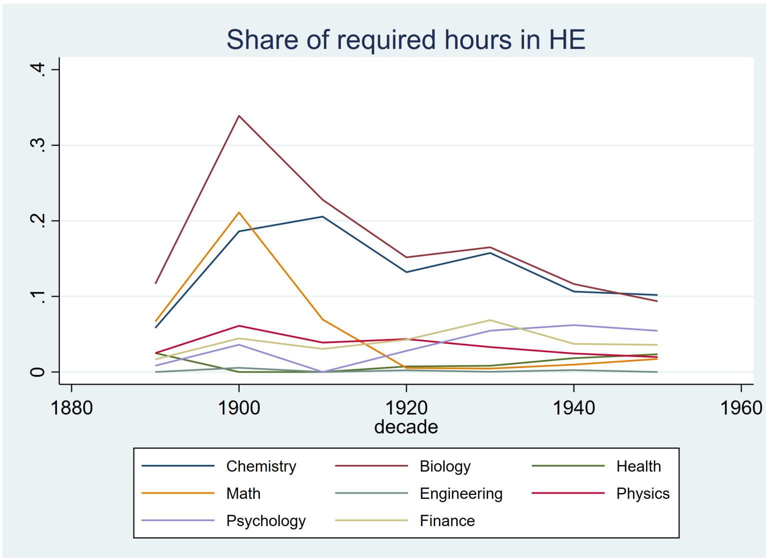
*Home Experience, F.&N. 207, required upon completion of F.&N. 205. See page 202.
**One credit is given upon the completion of three quarters' work.

JUNIOR YEAR

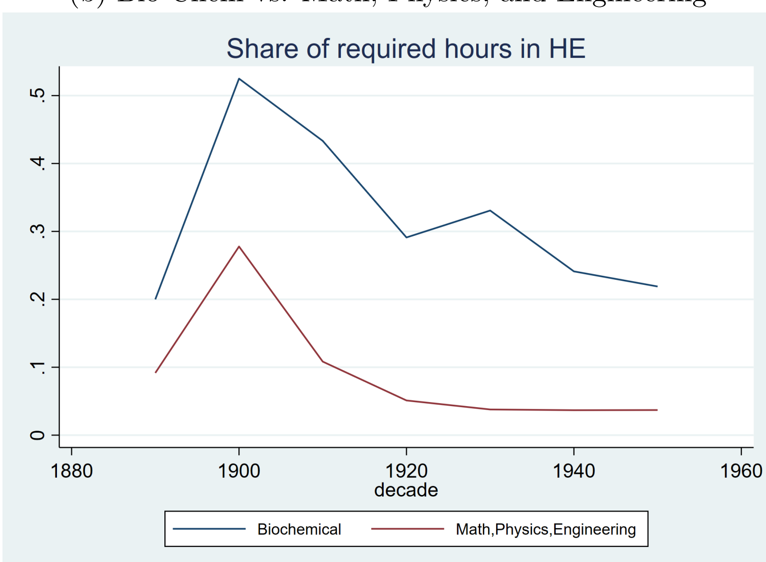
Large Quantity Cookery I.Mgt. 380	4	Meal Planning F.&N. 303	4	Nutrition and Dietetics F.&N. 305	4
Household Bacteriology Bact. 304B	5	Applied Sociology Ec. 384	3	Mid-19th Century Engl. 255 or **Electives in English	3
American Government Govt. 315	3	General Psychology Psych. 204	3	Extempore Speaking P.S. 311	3
Electives	3	Clothing T.&C. 224	3	Child. & Adolescence Psych. 415	3
		Electives	3	Electives	3

Figure 2: Share of Required Credits in Home Economics belonging to Different Subjects

(a) All Subjects



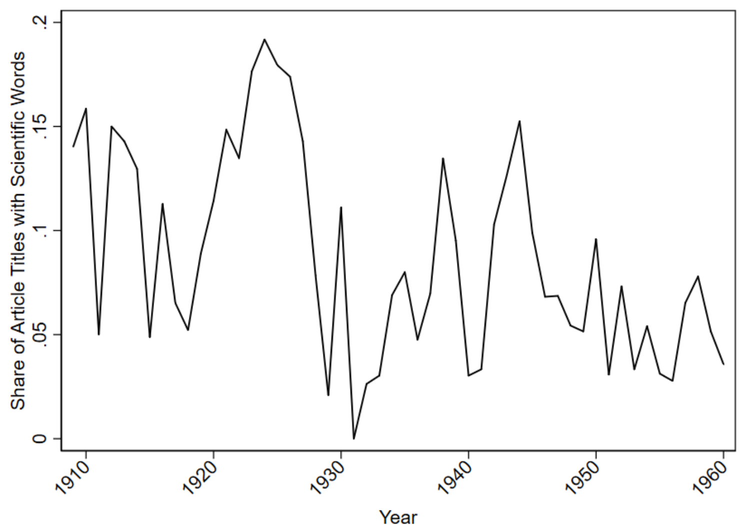
(b) Bio-Chem vs. Math, Physics, and Engineering



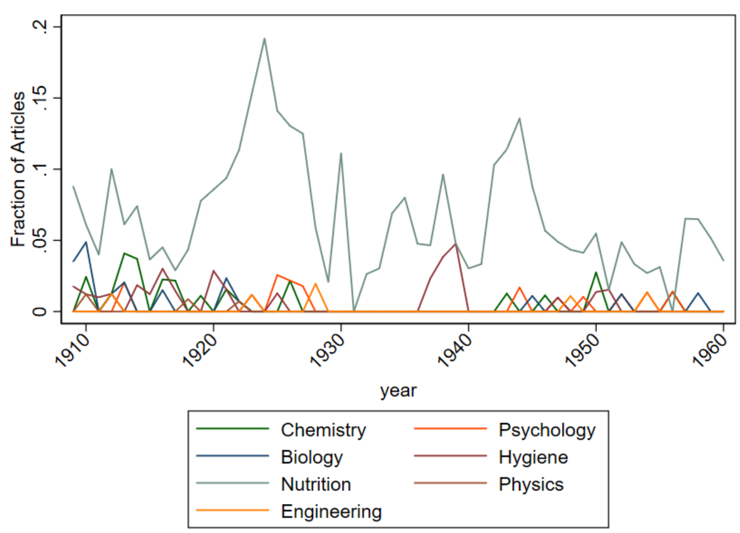
Notes: Share of required home economics credit hours belonging to different subjects. Data source: Course catalogs.

Figure 3: Share of Articles in the Journal of Home Economics that Mention a Science-Related Word in their Title

(a) Any Science-Related Word



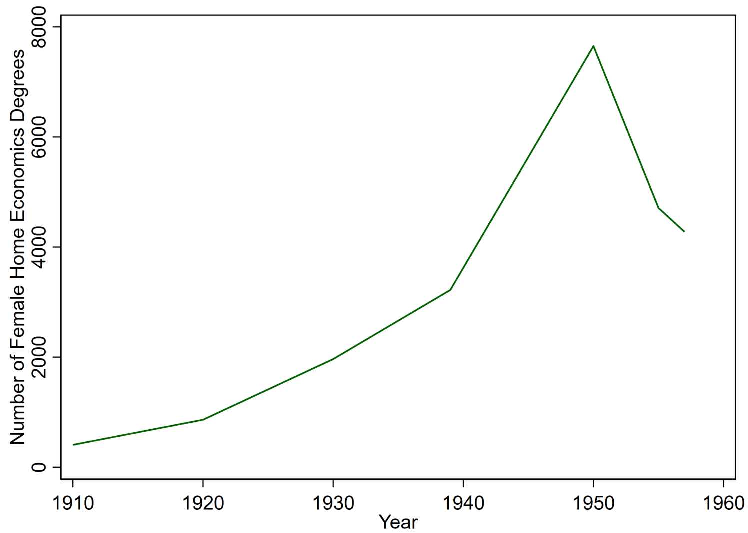
(b) Science Words by Field



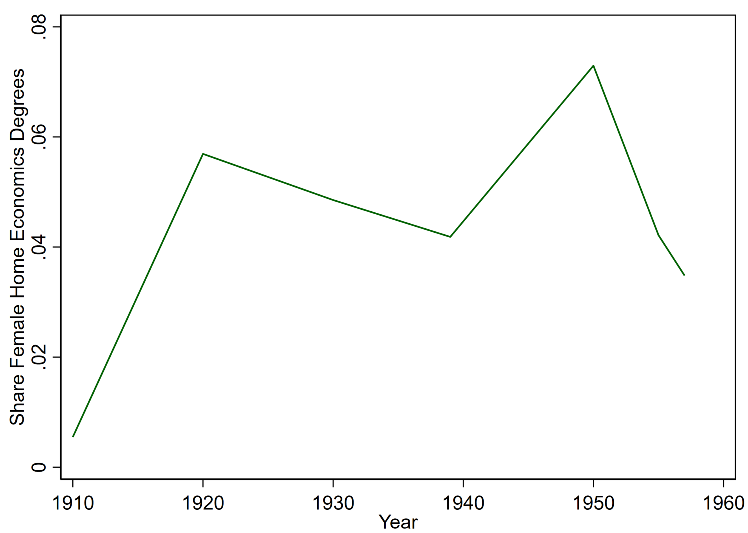
Notes: Share of articles that use a science-related word in their title. Source: Journal of Home Economics article titles, 1909-1960.

Figure 4: Female Home Economics Degrees Conferred by Year

(a) Total Number of Degrees

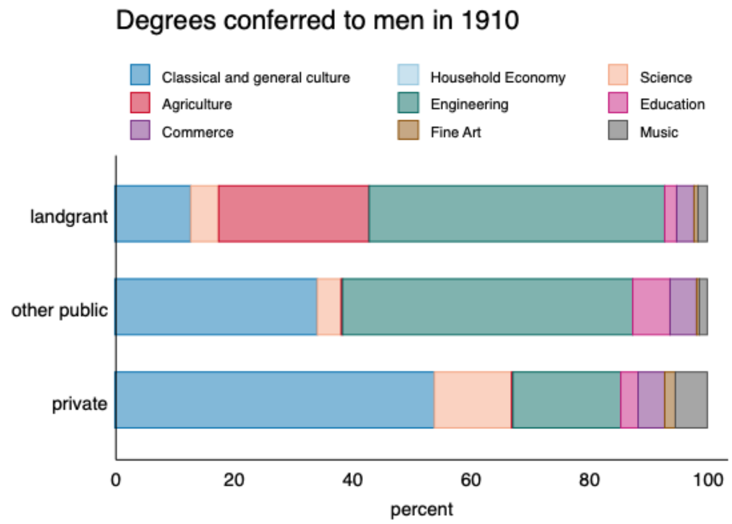


(b) As a Share of All Female Degrees



Notes: Number of degrees in home economics conferred to women (Panel (a)), and the number degrees in home economics conferred to women divided by the total number of degrees conferred to women (Panel (b)). Data source: Annual Report of the Commissioner of Education 1910; Biennial Survey of Education 1920, 1930, 1939, 1950, 1955, 1957.

Figure 5: Distribution of Majors by Institution Type



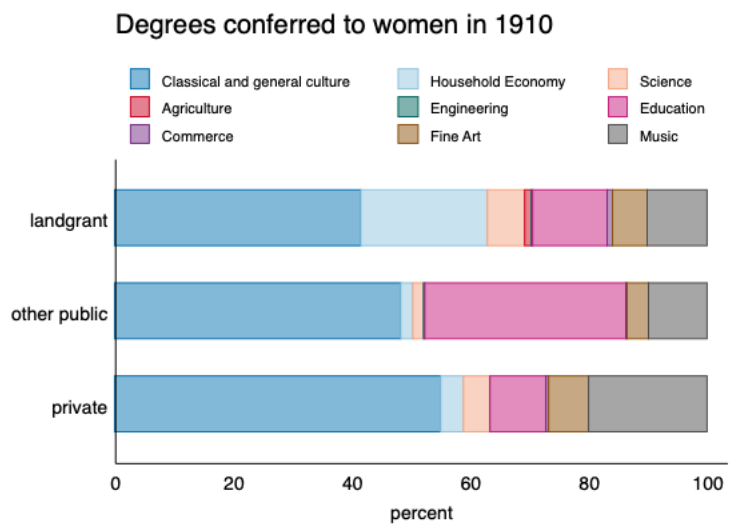
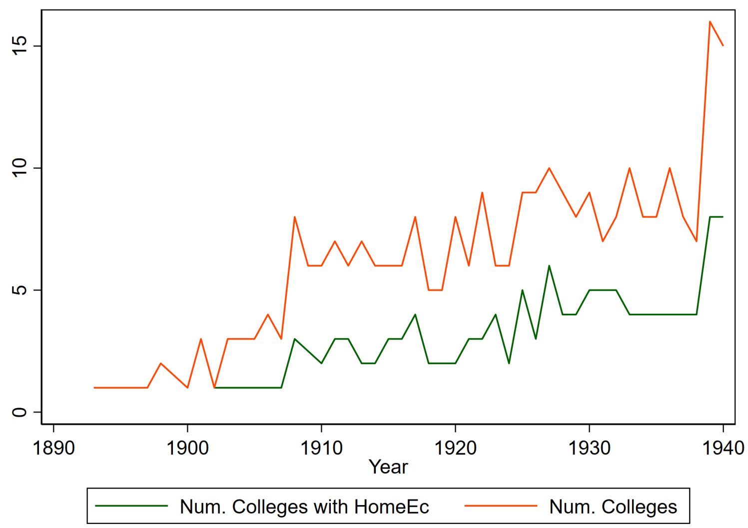


Figure 6: Home Economics Trends from the Yearbooks Sample

(a) The number of colleges offering Home Ec



(b) Declared majors in Home Ec

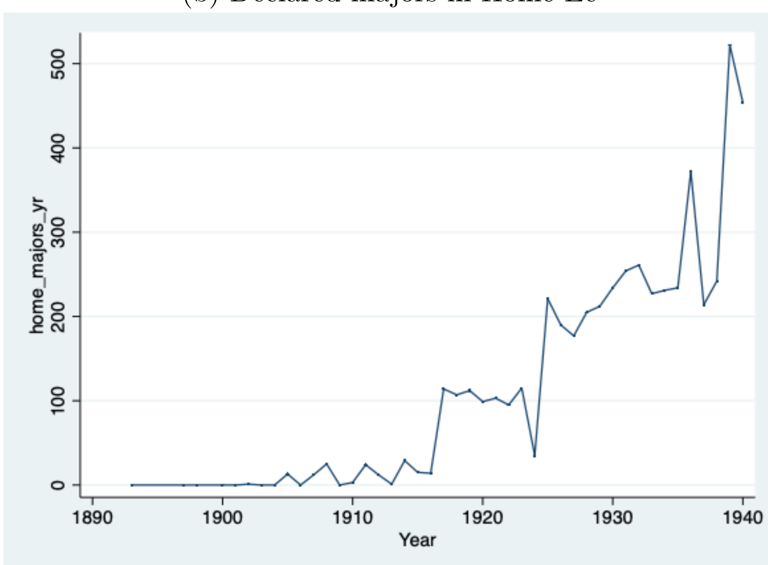
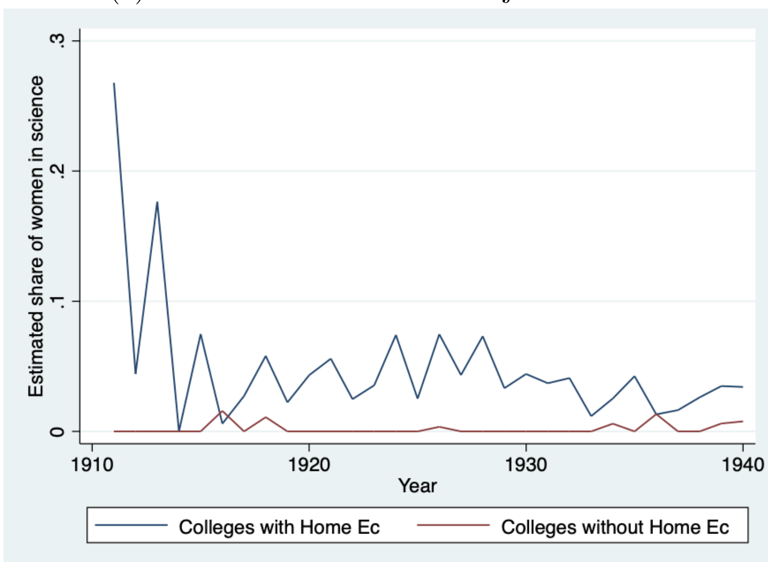
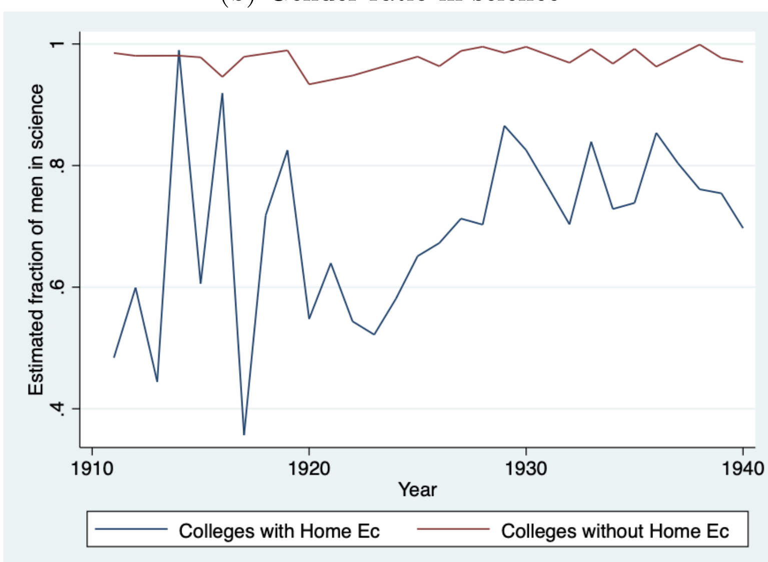


Figure 7: Women in Science for Colleges with and without Home Economics from the Yearbook Sample

(a) Fraction of women who major in science

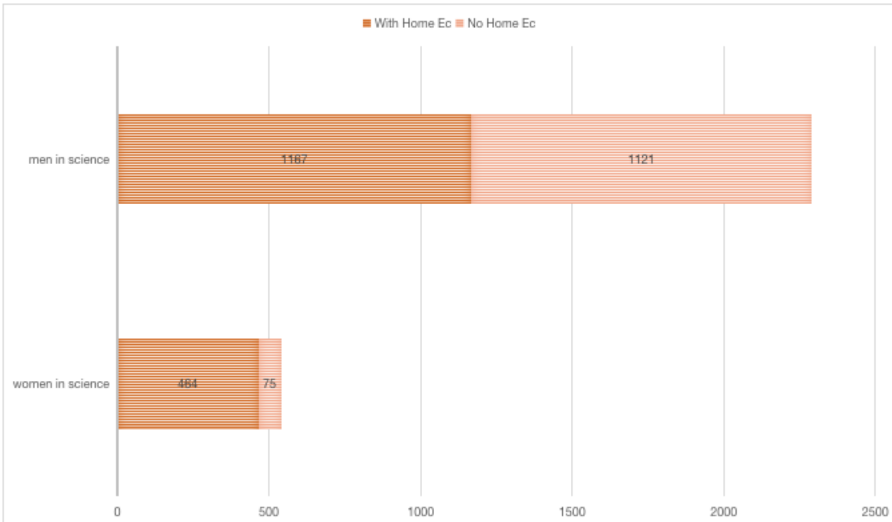


(b) Gender ratio in science



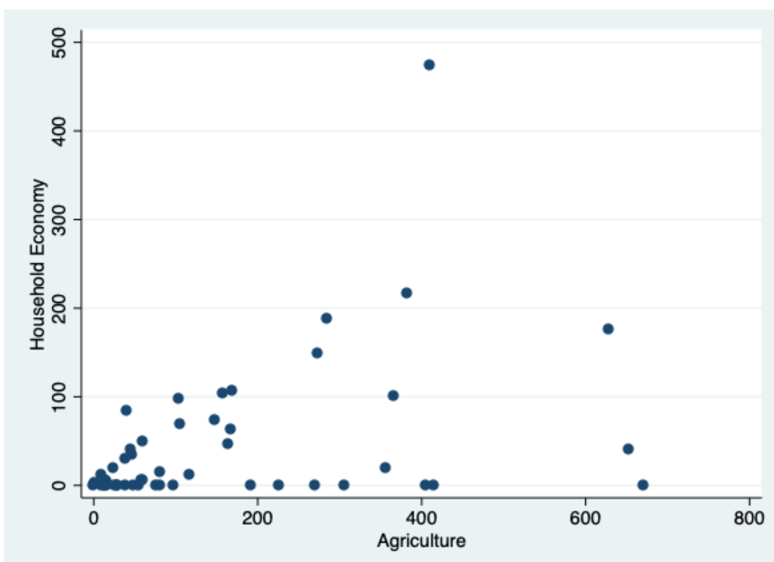
Notes: Unconditional mean share of women in science majors (women in science majors/total women) (Panel (a)) and gender ratio in science (men in science majors/ total science majors) (Panel (b)) for colleges with home economics and colleges without home economics in each year. A student is counted as women if the first name has a probability of male less than 50% Data source:the student yearbooks sample.

Figure 8: Number of Science Majors by College Home Economics Status from the Yearbook Sample



Notes: Number of science majors by gender and whether or not a college has home economics, for all yearbooks.

Figure 9: Home Ec and agriculture program sizes, 1910



Appendix

Table A1: Home Economics and Labor Market Outcomes

	Female Labor Force Participation Rate			Share of Women in Technical Occupations		
	(1)	(2)	(3)	(4)	(5)	(6)
Female Home Ec. Rate	-0.0000100	-0.0000459	0.000313**	0.000396***	0.000339***	0.0000816
	(0.000171)	(0.000127)	(0.000147)	(0.0000868)	(0.0000851)	(0.000103)
Observations	525	525	525	525	525	525
Adj. r^2	0.0965	0.127	0.235	0.0629	0.112	0.223
College Controls	No	Yes	Yes	No	Yes	Yes
County Controls	No	No	Yes	No	No	Yes
Mean Dep. Var. Rate	.195	.195	.195	.036	.036	.036

Standard errors in parentheses

* p¡0.10, ** p¡0.05, *** p¡0.010

Notes: The table reports OLS estimates. An observation is a county in 1920, 1930, or 1940. The dependent variable is the number of degrees in general science conferred to women. Women in home ec is the number of degrees conferred to women in home economics. University size controls include the total number of majors offered and the total number of degrees conferred at the college. Science related measures include the value of scientific apparatus, teaching expenses on natural sciences, and the number of degrees in general science conferred to men. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table A2: Home Economics and Labor Market Outcomes

	Female Labor Force Participation Rate			Share of Women in Technical Occupations		
	(1)	(2)	(3)	(4)	(5)	(6)
Female Home Ec. Rate	0.00670	0.00163	0.00464	0.00378	0.000935	-0.000330
	(0.00982)	(0.00363)	(0.00644)	(0.00469)	(0.00186)	(0.00170)
Observations	3570	3570	3570	3562	3562	3562
Adj. r^2	-0.441	0.0466	-0.0457	-0.364	0.00487	0.0368
College Controls	Yes	Yes	Yes	No	Yes	Yes
County Controls	Yes	No	Yes	No	No	Yes
Mean Dep. Var. Rate	.195	.195	.195	.036	.036	.036
First Stage F-stat	0.601	0.727	0.654	0.601	0.727	0.638

Standard errors in parentheses

* p¡0.10, ** p¡0.05, *** p¡0.010

Notes: The table reports OLS estimates. An observation is a county in 1920, 1930, or 1940. The dependent variable is the number of degrees in general science conferred to women. Women in home ec is the number of degrees conferred to women in home economics. University size controls include the total number of majors offered and the total number of degrees conferred at the college. Science related measures include the value of scientific apparatus, teaching expenses on natural sciences, and the number of degrees in general science conferred to men. *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.